

27 under 35 U.S.C. § 103(a) as allegedly being obvious over the combination of Bezzi, Takami, and Sanchez with Landis and DeHaven. Applicants, again, respectfully traverse this rejection.

Contrary to the Examiner's assertions, the present invention is distinguished from the combined teachings of Bezzi, Takami, and Sanchez with Landis and DeHaven. The present invention is drawn to a novel process for the production of substantially spherical aluminum oxide beads. The process involves passing an acidic aluminum oxide solution or an acidic aluminum oxide suspension through a vibrating annular nozzle plate, having at least 10 droplet nozzles, which produces aluminum oxide (*i.e.*, hydrosol) droplets that fall from the nozzles of a vibrating plate. The falling droplets pass through an ammonia gas stream, which is blown laterally against the falling droplets, in order to evenly gel the surface, thereof, into a substantially spherical shape. The droplets then fall into an aqueous ammonia solution, in which the droplets are coagulated to form substantially spherical aluminum oxide beads. The aluminum oxide beads are then removed from the solution. In another embodiment of the present invention, the ammonia gas is blown from the interior of the annular arrangement of the falling droplets.

**Bezzi Does Not Suggest The Formation Of Aluminum Oxide**

The Examiner maintains the assertion that while Bezzi specifically teaches the formation of *uranyl oxide beads*, using the disclosed apparatus, Bezzi discloses a generic process for the formation of other metal oxide beads. Therefore, the Examiner asserts that one of ordinary skill in the art would read Bezzi broadly enough to use the apparatus for the

production of the aluminum oxide beads of the present invention, as they are allegedly a species of the metal oxide beads taught in Bezzi.

Even assuming for the sake of argument that the Examiner's assertion is correct (which applicants assert is not the case), the Examiner has not explained how or why one of ordinary skill in the art having the teaching of Bezzi, would specifically choose aluminum oxide from such a broad genus of metal oxide compounds, absent any specific teaching or suggestion to make the choice. The total lack of any suggestion in Bezzi to make any specific metal oxide beads (other than uranyl oxide), therefore, would not lead one of ordinary skill in the art to the teachings of Takumi or Sanchez, which specifically teach the formation of aluminum oxide using substantially distinct reactive processes.

In order for the reference combination to be proper, the standard of obviousness under 35 U.S.C. § 103 requires that the teachings of the primary reference (*i.e.*, Bezzi) must lead the skilled artisan to the teachings of the secondary reference. Further, where the rationale for making the combination is not readily apparent from the combined teachings, it is incumbent upon the Examiner to explain why the combination is proper. *Ex parte Skinner*, 2 USPQ2d 1788, 1790 (BPAI 1986). As such, the Examiner has not offered any explanation of why aluminum oxide would have been specifically chosen, based on the teaching of Bezzi.

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#### **Applicants Do Not Use Ammonia As A Reactive Gas**

Applicants reiterate the argument that there is nothing in Bezzi which teaches or suggests that the process is compatible with the production the aluminum oxide beads of the present invention. The chemistry of the present invention is distinct from that of the

Bezzi process. To support this argument, during the interview, applicants pointed out that the ammonium gas which is blown against the falling droplets of uranyl nitrate in the Bezzi process, is a reactive gas which converts the uranyl nitrate droplets to the product uranyl oxide beads. The uranyl nitrate compound of Bezzi undergoes a hydrolysis reaction which is facilitated by an increase in the pH of the solution as it passes through the ammonia gas stream, which results in the precipitation of ammonium uranyl hydroxide (*i.e.*, ammoniumdiuranate). This process occurs at a pH of about 3 and higher. The conversion to uranyl oxide is completed as the ammoniumdiuranate falls through the aqueous ammonium hydroxide.

In contrast, the ammonia gas of the present invention does not function as a reactive gas, but rather as a gelling agent. There is no chemical conversion of the aluminum oxide droplets to a different chemical compound. The Examiner, however, rebutted this argument by asserting that the aluminum oxide of the present invention undergoes an acid/base neutralization reaction. This assertion is respectfully traversed for the reasons stated below. This assertion is traversed because an insoluble "salt" is not being formed in the present invention.

The ammonia gas of the present invention functions as a polymerization catalyst to initiate gelling (*i.e.*, pre-solidification) of the liquid aluminum hydrosol droplets. The gelling results in the formation of a solid skin of aluminum hydroxide (*i.e.*,  $\text{Al(OH)}_3$ ) on the outer surface of the hydrosol droplet; not the formation of  $\text{NH}_4\text{Al(OH)}_2$ , which is the result of a chemical reaction with the ammonia gas. Further, the  $\text{Al(OH)}_3$  of the present invention is not a monomeric molecule, precipitated by a chemical reaction, but rather is a polymeric network of  $[\text{Al(OH)}_3]_n$ , which is formed as a droplet passes through the ammonia gas.

Ammonia is not in any way incorporated into the  $[Al(OH)_3]_n$  polymer. The formation of aluminum oxide beads in the present invention, therefore, is the result of ammonia gas initiated polymerization of the  $Al(OH)_3$  within the hydrosol droplets, and not by a chemical reaction with the ammonia gas through which the droplets fall. The chemistry of the present invention, therefore, is distinct from that of Bezzi.

**Specific Features Of The Present Invention Are Missing From Bezzi**

Applicants also pointed out to the Examiner during the interview, that several features of the present invention were not taught or suggested by Bezzi, particularly, blowing ammonia gas laterally from the interior of the annular arrangement of droplet nozzles. The Examiner made reference to the falling droplets pulling air into the ammonia gas stream as they fell, thereby creating turbulence resulting in non-uniform contact of the ammonia gas with the droplet and, consequently, non-uniform gelling of the droplets. He then asserted that it would have been obvious from the teaching of Bezzi for one of ordinary skill in the art to practice this embodiment of the present invention (*i.e.*, blowing ammonia from the interior of the annular arrangement of the droplet nozzles) in order to maintain uniform gelling of the falling droplets.

Contrary to the Examiner's assertion, while an increase in the number of droplet nozzles in the annular arrangement may reduce the ability of ammonia gas, blown from the exterior of the annular nozzle plate, to evenly gel the falling droplets toward the center of the nozzle plate, applicants have discovered that gelling is greatly improved if the ammonia gas is blown from the interior of the annular arrangement of droplet nozzles. This improvement

in gelling is the result of a reduction in the amount of air which is carried into the ammonia gas stream by the falling droplets.

Further, the additional use of an exterior ring of ammonia provides added improvement to the gelling characteristics. Other parameters which may be varied are the size of the ammonia gas outlet, which controls the thickness of the gas stream, or the pressure at which the gas is blown against the falling droplets.

Applicants traverse the Examiner's assertion of obviousness because one of ordinary skill in the art reading Bezzi would not have considered the problem of uniform gelling by contact with ammonia gas, because only a single nozzle producing one droplet stream is disclosed. No annular arrangement of droplet nozzles is suggested or disclosed by Bezzi and therefore, there is no motivation leading one to consider using an nozzle arrangement that would render the present invention obvious.

During the interview, the Examiner rebutted this argument by pointing out that Bezzi also discloses the use of a spinneret, and therefore, renders the nozzle plate of the present invention obvious. Contrary to this assertion, a spinneret is distinct from the nozzle plate of the present invention, in that a spinneret is designed for the production of threads and fibers under high pressure, which results in "spraying", rather than droplet formation.

Even if a spinneret were used, Bezzi does not teach or suggest modifying the flow of the ammonia gas against the falling droplets to promote uniform reaction of the gas with the falling uranyl nitrate droplets. Further, there is no indication by Bezzi of the spinneret type or its characteristics which would be used in the apparatus of Bezzi. Absent any a suggestion of spinneret type or its characteristics, no motivation exists to lead one of

ordinary skill to consider how to adjust the flow of the ammonia gas against the falling droplets, in a manner that would render obvious the present invention.

**Cited References Are Not Combinable**

As Bezzi does not teach or suggest (i) making aluminum oxide beads or (ii) using an annular nozzle plate with ten or more droplet nozzles, wherein (iii) ammonia gas is blown against the falling droplets from the interior of the annular arrangement of falling droplets, the motivating disclosure required to lead one of ordinary skill in the art to any of the secondary references as applied by the Examiner, is not present. The Examiner's citation of Takumi, Sanchez, Landis and DeHaven each disclose isolated elements of the present invention.

Both Takumi and Sanchez teach the formation of aluminum oxide using drop methods which are chemically different and not compatible with the teaching of Bezzi. Both Landis and DeHaven respectively teach the formation of urea and ammonium nitrate, using apparatus which are structurally distinct from that disclosed by Bezzi. Landis teaches spraying molten urea through nozzles into a solidification zone of a prilling tower. There is no teaching or suggestion of using a vibrating nozzle plate having ten or more droplet nozzles to form droplets. DeHaven teaches a plurality of vibrating nozzles which are attached to a linear pipe. There is no suggestion of an annular nozzle plate having ten or more droplet nozzles, further having a source of ammonia blown from the interior of the annular arrangement.

The Examiner has essentially produced the present invention by combining the teachings of individual components disclosed in the cited references, and concludes that it

would have been obvious to combine the references in a manner that renders obvious the present invention. It has, however, been held by the Board of Patent Appeals and Interferences and the Federal Circuit, that citing references which merely indicate that isolated elements and/or features recited in the claims are known, is not a sufficient basis for concluding that the combination of claimed elements would have been obvious. *In re Hiyamizu*, 10 USPQ2d 1393, 1394 (BPAI 1988), *ACS Hospital System, Inc. v. Montefiore Hospital*, 221 USPQ 929, 933 (CAFC 1984).

Applicants' claimed invention, therefore, is not made obvious by the combined teachings of the above cited references, as alleged by the Examiner. Contrary to the Examiner's assertion, one of ordinary skill in the art would not be led to the claimed invention by the combined teachings of the above cited references because:

(i) there is no suggestion in Bezzi to form aluminum oxide beads and therefore, no motivation to combine the cited secondary references;

(ii) the reactive components of the present invention are missing or distinct from those disclosed in the cited references; and

(iii) there is no teaching, suggestion or Examiner explanation of how the prior art disclosed elements should be combined in a manner which renders obvious the present invention.

Therefore, the Examiner has not established a *prima facie case* of obviousness, and withdrawal of this rejection is respectfully requested.

**CONCLUSION**

Having fully responded to the outstanding rejections, applicants submit that claims 19-27 are allowable over the cited prior art of record. Withdrawal of the outstanding rejections and issuance of a Notice of Allowance are earnestly solicited.

If any issues remain unresolved, the Examiner is invited to contact the undersigned counsel to resolve such remaining issues, for the purpose of advancing the prosecution of this application toward allowance.

Respectfully Submitted,

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